WELCOME

NFPA 58
LIQUEFIED PETROLEUM GAS CODE

A Joint Presentation Developed by the National Fire Protection Association & Propane Education and Research Council

PROPANE education & research COUNCIL

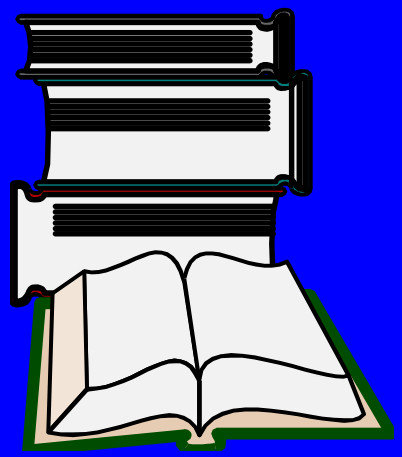
NFPA®

Liquefied Petroleum Gas Code Handbook

- A book filled with the complete 1998 Liquefied Petroleum Gas Code, and
  - Commentary that explains the reasons for, use of, or application of the code requirements
  - Photographs and drawings showing equipment covered by the code and installations
  - Supplements on subjects of special interest

How is the Code Revised?

- Proposals presented - form in back of book
- Committee acts on proposals
  - Actions published for comments
- Committee acts on comments
  - Actions published
- Code published in 3 year cycles
- Proposals & comments on NFPA website



NFPA 58
LP-Gas Code

- Ch. 1 General Provisions
- Ch. 2 LP-Gas Equipment and Appliances
- Ch. 3 Installation of LP-Gas Systems
- Ch. 4 LP-Gas Liquid Transfer
- Ch. 5 Storage of Cylinders Awaiting Use Resale, or Exchange
- Ch. 6 Vehicular Transportation of LP-Gas

NFPA 58
LP-Gas Code

- Ch. 7 Building or Structures Housing LP-Gas Distribution Facilities
- Ch. 8 Engine Fuel Systems
- Ch. 9 Refrigerated Containers
- Ch. 10 Marine Shipping and Receiving
- Ch. 11 Pipe and Tubing Sizing Tables
- Ch. 12 Reference Publications
- Appendices A-J

Overview

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Seminar Modules

Interactive Modules

A. Equipment & Installation	(Ch. 2,3,&11)
B. Transfer & Storage	(Ch. 4&5)
C. Vehicular Transportation	(Ch. 6)
D. Distribution Facilities	(Ch. 7)
E. Engine Fuel Systems	(Ch. 8)
F. Refrigerated Containers	(Ch. 9)
G. Marine Shipping and Receiving	(Ch. 10)

Local Requirements

- Summarize local regulations, if applicable.

1 Non-Application of NFPA 58

- Frozen ground & cavern storage
- Natural gas plants refineries, chemical & petrochemical plants
- Utility gas plants: see NFPA 59
- LP-Gas used with oxygen: see NFPA 51
- LP-Gas systems covered by NPFA 54
- Transport by air, rail, water - DOT jurisdiction
- Marine applications: see NFPA 302

Ch. 1-1.3

NFPA®

1 Alternate Materials, Equipment, & Procedures

"The provisions of this code are not intended to prevent the use of any material, or method of construction, or installation procedure not specifically prescribed by this code, provided any such alternate is acceptable to the AHJ. The AHJ **shall require** that sufficient evidence be submitted to substantiate any claims made regarding the safety of such alternates."

Ch. 1-1.4

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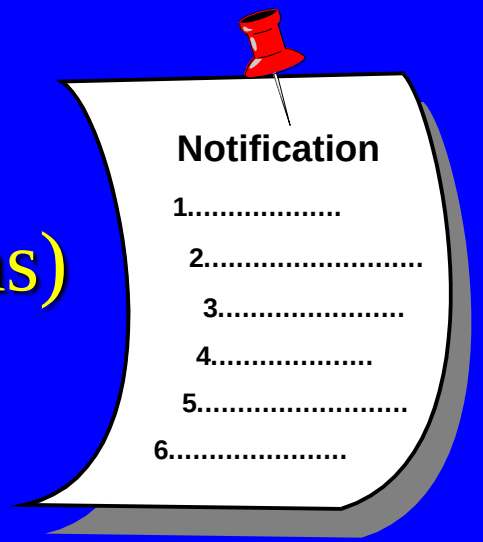
1 Notification of Installations

- Plans for fixed installations with > 2,000 gal storage (> 4,000 total) require notification of AHJ prior to starting installation

- Temporary installations (> 6 months) require notification if > 2,000 gal storage (> 4,000 total)

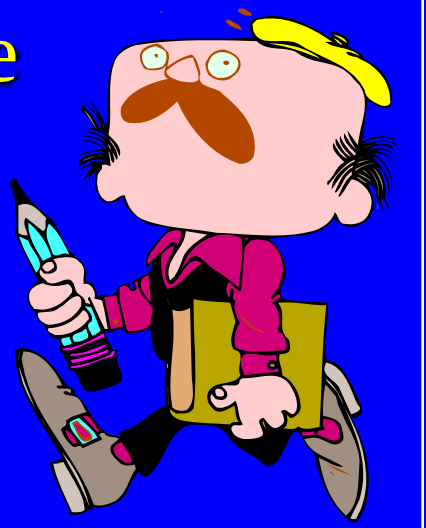


Ch. 1-4

NFPA®

1 Qualification of Personnel

- Persons who transfer liquid LP-Gas, who are employed to transport LP-Gas, or whose primary duties fall within the scope of this code shall be trained in proper handling procedures. The training shall be documented



- Previously required proof of training

Ch. 1-5

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1 Definitions & Terms

- ASME Container (or Tank) - A container constructed in accordance with American Society of Mechanical Engineers Code
- Container - Any vessel, including cylinders, tanks, portable tanks, and cargo tanks used for the transporting or storing of LP-Gas
- Cylinder - A container constructed in accordance with U.S. Department of Transportation (DOT) specifications

Ch. 1-6

NFPA®

1 Definitions & Terms

- Bulk Plant - A facility, the primary purpose of which is the distribution of LP-Gas by tank car, tank truck, or piping, distributing this gas to the end user by portable container delivery, by tank truck, or through gas piping

- Industrial Plant - An industrial facility that utilizes gas incidental to plant operations, w/ LP-Gas storage of 2000 gal. water cap. or more, and that receives gas by means of tank car, truck transport, or truck lots

Ch. 1-6

NFPA®

1 Definitions & Terms

- Authority Having Jurisdiction (a.k.a. AHJ) - The organization, office, or individual responsible for approving equipment, an installation, or a procedure
- Dispensing Station - Fixed equipment where LP-Gas is stored & dispensed into portable containers. Public can be permitted access to the dispensing station area
- Point of Transfer - The location where connections and disconnections are made or where LP-Gas is vented to the atmosphere in the course of transfer operations

Ch. 1-6

NFPA®

1 Definitions & Terms

- Container Appurtenances - Items connected to the container openings needed to make a container a gastight entity. These include, but are not limited to, pressure relief devices; shutoff, backflow check, excess-flow check, and internal valves; liquid level gauges; pressure gauges; and plugs

- Water Capacity - The amount of water, in either pounds or gallons, at 60°F (15.6°C) required to fill a container liquid full of water

Ch. 1-6

NFPA®

DOT Cylinder Conversion Handbook Table 2.1

	Propane Capacity		Water Capacity	
Type	Pounds	Gallons	Pounds	Gallons
Stationary	420	99	1000	119
Stationary	300	71	715	86
Stationary	200	47	477	57
Stationary	150	35	357	43
Exchange	100	24	239	29
Exchange	60	14	144	17
Motor fuel	33.5	8	88	9.6
Portable	40	9.5	95	11
Portable	20	4.7	48	5.7
Portable	5	1.2	12	1.4

* Based on 80% fill limit

General

ASME Tank Conversion Handbook Table 2.2

	Water Capacity	LP-Gas Capacity	
Type	Gallons	Gallons	Pounds
Domestic	100	80	338
Domestic	125	100	423
Domestic	150	120	508
Domestic	250	200	848
Ind/agr/com.	1,000-5,000	800-4,500	
Service Stations	1,000-6,500	800-5,850	
Bulk or storage	12,000-18,000	10,800-16,200	
Bulk or storage	20,000-30,000	18,000-27,000	
Bulk or storage	30,000-60,000	27,000-54,000	
Bulk or storage	60,000-120,000	54,000-96,000	

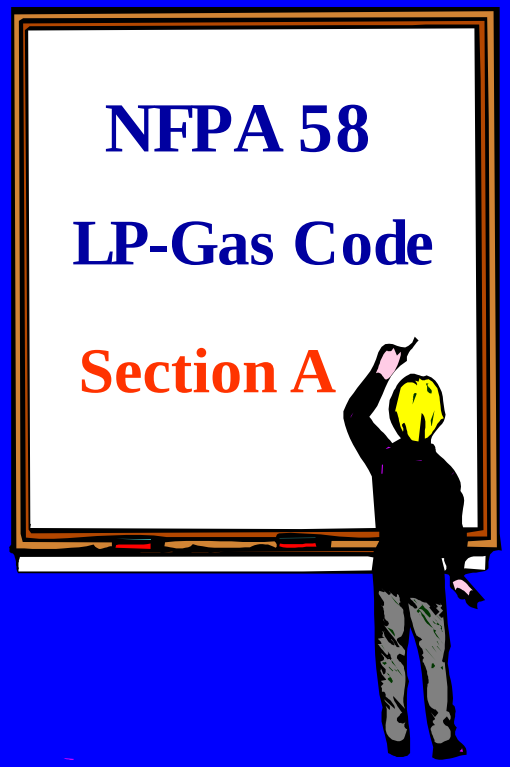
General

Section A
Equipment & Installation

Objectives

Provide participants with the ability to locate and apply information related to the requirements of LP Gas

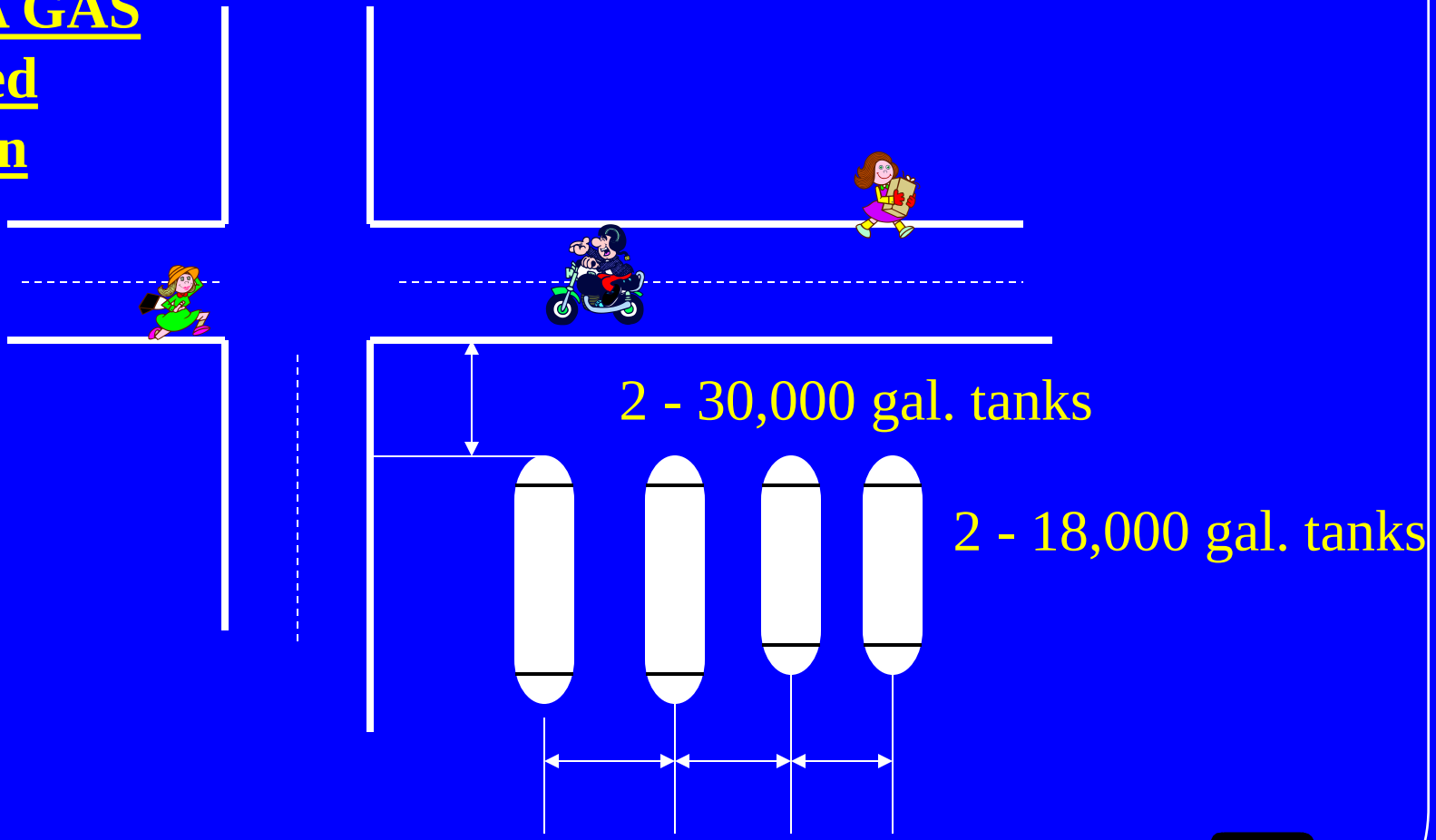
1. Equipment;
2. System Installation



Ch. 2,3,&11

Section A - Problem 1

ALPHA GAS
Proposed
Site Plan



Section A

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Section A - Problem 1

Alpha Gas has proposed a site development plan to place 2 - 30,000 gal. & 2 - 18,000 gal. LP-Gas tanks on their site. The tank dimensions are

30,000 gal. - 11‘(D) x 47‘(L)

18,000 gal. - 9‘(D) x 41‘(L)

1. What table is used to determine the distances?
2. What are the distances required on the plan?

2 LP-Gas Equipment & Appliances

- 2-1 Scope
  - Covers all components, containers & container assemblies
- 2-2 Containers
- 2-3 Container Appurtenances
- 2-4 Piping (Incl. Hose), Fittings, & Valves
- 2-5 Equipment
- 2-6 Appliance

Ch. 2

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2 Containers

- ASME, Section VIII
  - No retest or requalification mandated
  - Containers built to older ASME codes OK
- DOT: Requalification per DOT rules
  - 5 year visual method most common
  - 12 year full hydrostatic method rare for propane
- Dented, bulging, corroded - remove from service
- Repairs per code of manufacturer

Ch. 2-2

NFPA®

2 Container Safety Requirements

- Do **not** fill if not suitable for continued service
- **No** refill unless qualified for LP-Gas service
- Containers involved in a fire w/ **no** distortion must be requalified
- Portables must have appurtenance protection (collar or cap)

- Pressure relief valve must communicate w/ vapor space

Ch. 2-2

NFPA®

2 Container Filling & Evaluation

- Volumetrically filled tanks 30 - 2,000 gal., must be filled in vapor space
- Containers > 125 gal, require a liquid evacuation connection, > 3/4” NPT
- Containers of 2,000+ gal. water capacity need pressure gauge opening
- Connections for pressure relief valves must have direct communication with vapor

Ch. 2-2.3

NFPA®

2 Actuated Liquid Withdrawal Excess Flow Valve

- Name given to “Check-Lok”, “Check-Mate”, etc.
- Defined in 1.6
- For field emptying tanks prior to transportation
- Upper limit on size of container requiring valve set at 2,000 gal.
- Refer to 2-3.3.2 (a)

Ch. 2-2.3.3

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2 Container Markings

- ASME markings on stainless steel nameplate
- Unodorized LP-Gas marked in 4” letters on 2 sides or ends of container

Ch. 2-2.6

NFPA®

2 Unodorized Gas Requirements

- All ASME tanks unodorized gas must be marked:

“NOT ODORIZED”

- Letters 4” high min.
- Mark on two ends or sides of tank

Ch. 2-2.6.5

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2 Container Appurtenances

- Must be fabricated of materials suitable for LP-Gas service
- Pressure-containing metal parts of appurtenances, min. melting of 1,500°F
- **No** non-metallics for bonnets or bodies
- Working pressure 250 psi min.
- **No** cast iron

Ch. 2-3

NFPA®

2 Pressure Relief Devices

- Containers must have pressure relief devices
- Pressure relief valves or fuse plugs per DOT
- Small cylinders: pressure relief device to prevent "rocketing" in a fire
- ASME containers: spring-loaded PRV (UL 132)
  - Exception: Containers of >40,000 gal. can use pilot operated PRV
- DOT - 375 psi, ASME - 250 psi

Ch. 2-3.2

NFPA®

2 Containers 2000 Gallons or Less

- Table 2-3.2.2 (a) provides a complete list of required container appurtenances for containers 2000 gal. or less, including:
  - Valves
  - Check valves
  - Actuated liquid withdrawal excess flow valves
  - Overfilling prevention devices

Ch. 2-3.3.2(a)

NFPA®

2 Connection & Appurtenance Requirements

Part	Appurtenance	1.) Cylinders 2-100 lb Prop. vapor service	2.) Cylinders 2-100 lb Prop. liquid service
A	MSV w/ overfilling prevention & integral PRV device	R [see2.3.2.2 and 2.3.3.2 (a)5]	
F	Fixed maximum liquid level gauge	R [see 2.3.3.2 (a)5]	O
I	Float gauge	O	O

Table 2-3.3.2(a)

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2 Connection & Appurtenance Requirements

Part	Appurtenance	4.) Cylinders 100 - 420 lb Prop. filled on site
D	Double backflow check filler valve	R
E	Manual shutoff valve for vapor service	R
F	Fixed maximum liquid level gauge	R
G	External PRV	R
H	Internal spring-type PRV	

Table 2-3.3.2(a)

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2 Containers Over 2,000 Gallons Water Capacity

Vapor and liquid withdrawal openings:

- A valve as close to the tank as practical with an internal excess flow valve
- An internal valve with an integral excess flow valve or excess flow protection

Ch. 2-3.3.2(b)

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2 Containers Over 2,000 Gallons Water Capacity

For vapor and liquid inlet openings:

- Valve as close to tank as practical, in combo w/:
  - A internal back check or excess flow valve
  - An internal valve w/ excess flow protection, or
  - An internal valve w/ remote means of closure.

Ch. 2-3.3.2(b)

2 Containers Over 2,000 Gallon Water Capacity

- Other Required Appurtenances:
  - Internal spring-type, flush-type full internal, or external PRV
  - Fixed liquid level gauge
  - Float, rotary, or slip tube gauge, or a combination
  - Pressure & temperature gauges

Ch. 2-3.3.2(b)

2 Piping (Including Hose), Fittings, and Valves

- Pipe & tubing materials listed in 58, or be investigated & tested to be safe, recommended by manufacturer, & AHJ acceptable
- Liquid piping that can be isolated by valves - hydrostatic relief valve & 350 psi design pressure
- Valves must be steel, iron, or brass
- Valve design pressure: 250 psi min., 350 psi if used above container pressure

Ch. 2-4

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2 Piping

- Wrought iron or steel (black or galvanized), brass, copper, or polyethylene
  - Wrought-iron pipe; ANSI B36.10M
  - Steel pipe; ASTM A 53 or ASTM A 106
  - Brass pipe; ASTM B 43
  - Copper pipe; ASTM B 42
  - Polyethylene pipe; ASTM D 2513
  - Other materials if recommended by manufacturer & AHJ acceptable

Ch. 2-4

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2 Tubing

- Steel, brass, copper, or polyethylene
  - Steel tubing; ASTM A 539
  - Brass tubing; ASTM B 135
  - Copper Tubing - Type K or L; ASTM B 88 or Air Conditioning & Refrigeration; ASTM B 280
  - Polyethylene tubing; ASTM D 2513
  - Corrugated stainless steel ANSI/AGI LC1
  - Other materials if recommended by manufacturer AHJ acceptable

Ch. 2-4

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2 Fittings for Pipe and Tubing

- Steel, brass, copper, malleable iron, ductile (nodular) iron, or plastic
- **No** cast-iron fittings

- Polyethylene fittings must comply w/ ASTM D 2513, & be recommended for LP-Gas by the manufacturer
- Anodeless risers OK for polyethylene

Ch. 2-4.4

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3 Installation of LP-Gas Systems

- 3-1 General
- 3-2 General Provisions
- 3-3 Bulk Plant & Industrial Systems
- 3-4 Systems in Buildings
- 3-5 Installation of Appliances

3 Installation of LP-Gas Systems

- 3-6 Vaporizer Installation
- 3-7 Ignition Source Control
- 3-8 Systems on Vehicles
- 3-9 Dispensers & Dispensing Stations
- 3-10 Fire Protection
- 3-11 Installation of ASME Containers

3 General Installation Provisions

- LP-Gas containers must be located outside buildings **except** for
  - Portables w/ specific limitations
  - Portables being filled in buildings designed for filling
  - Containers on LP-Gas vehicles
  - Containers used for engine fuel systems
  - Fuel containers on industrial trucks
  - Others listed in Ch. 3-2.2.1

Ch. 3-2

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3 General Installation Provisions

Example LP-Gas Cylinder Installations

Ch. 3-2

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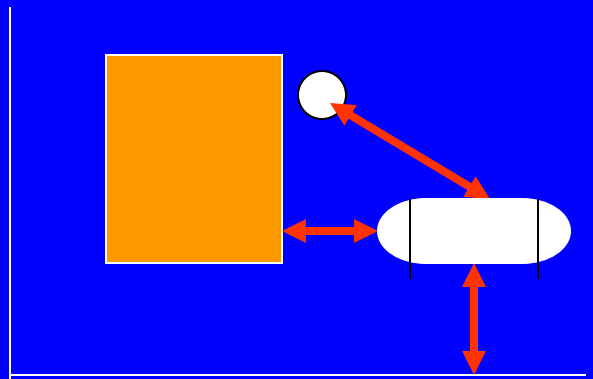
3 Separation Distances

- Table 3-2.2.2
- Containers installed outside of buildings
- Portable or permanent
- Located w/respect to nearest
  - Container
  - Important building
  - Group of buildings
  - Adjoining property line of buildable property



Ch. 3-2.2.2

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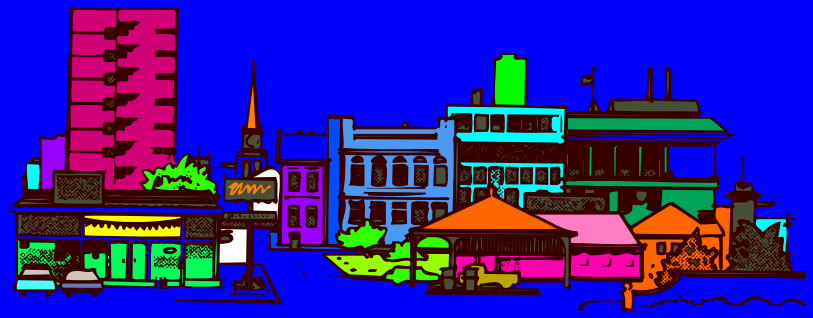
3 Important Buildings

A building can be "important" because of:

1. Replacement value
2. Human occupancy
3. Value of the contents



4. Vital role in business' function or records
5. It's effect on leak & fire control activities in an emergency situation

Ch. 3-2.2.2

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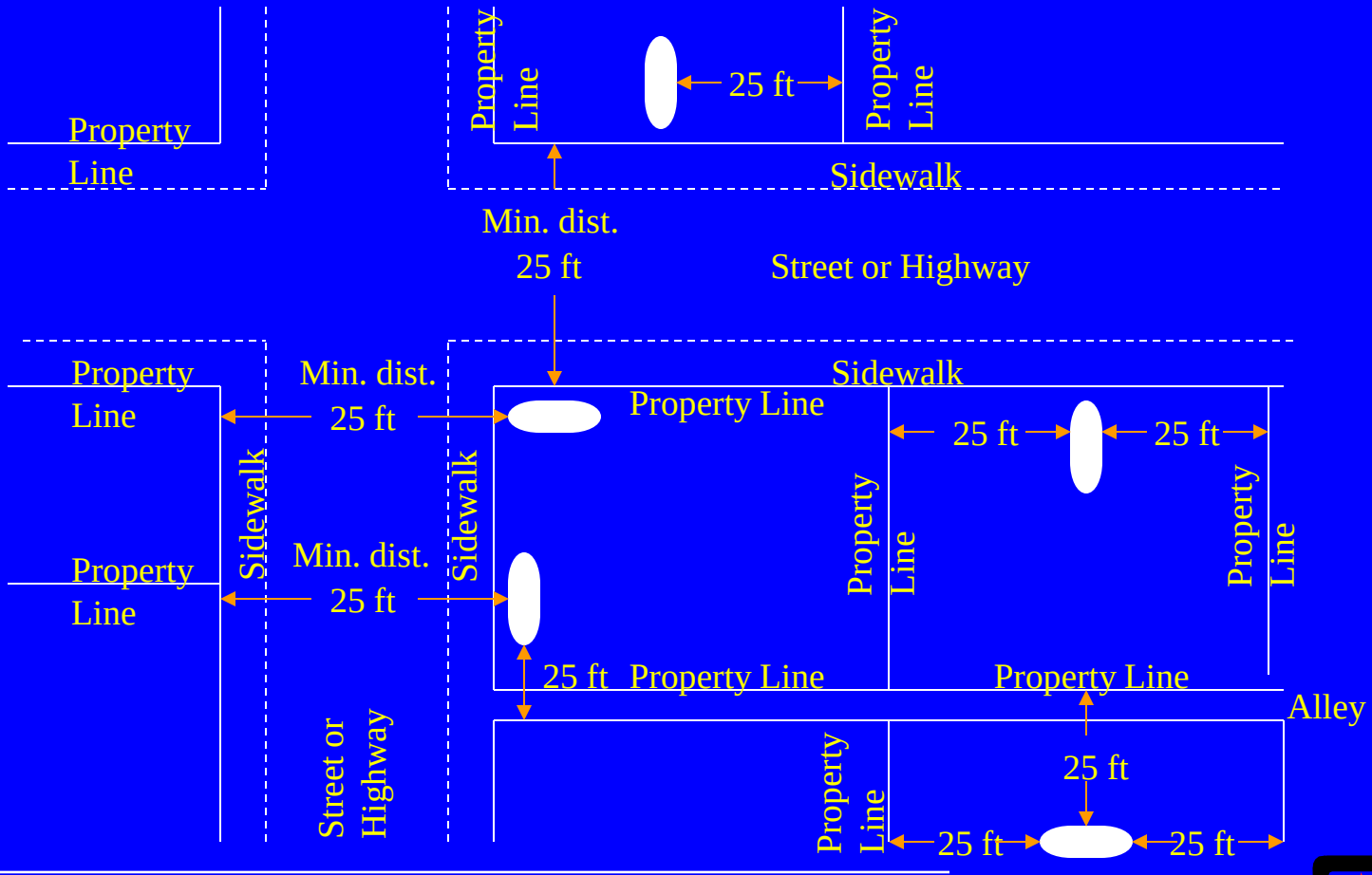
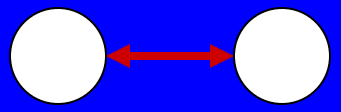
3 Separation Distances



Ch. 3-2.2.2

3 Minimum Distances



Water Cap/Cont.	Underground	Aboveground	Between
< 125 Gal.	10 Ft.	0 Ft.	0 Ft.
125-250	10	10	0
251-500	10	10	3
501-2,000	10	25	3
2,001-30,000	50	50	5
30,001-70,000	50	75	
70,001-90,000	50	100	
90,001-120,000	50	125	
120,001-200,000	50	200	
200,000-1,000,000	50	300	
Over 1,000,000	50	400	

1/4 of sum of diameters of adjacent containers

Table 3-2.2.2

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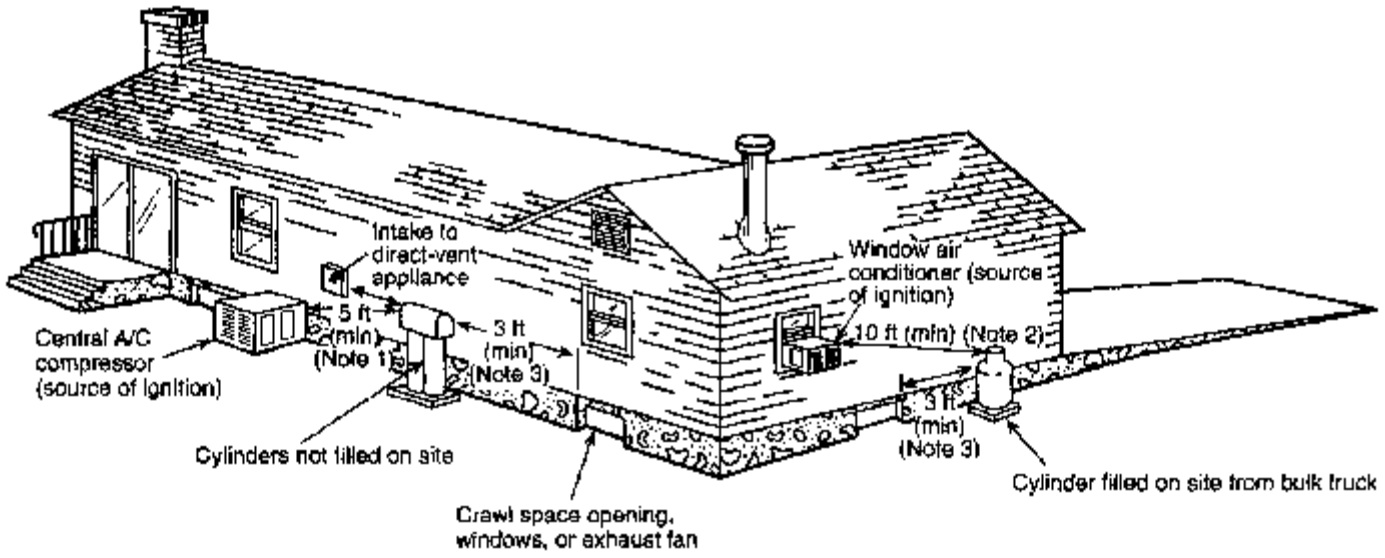
3 Minimum Distances



For SI units: 1 ft = 0.3048 m

Note 1: 5-ft minimum from relief valve in any direction away from any exterior source of ignition, openings into direct-vent appliances, or mechanical ventilation air intakes. Refer to 3-2.2.2(b).

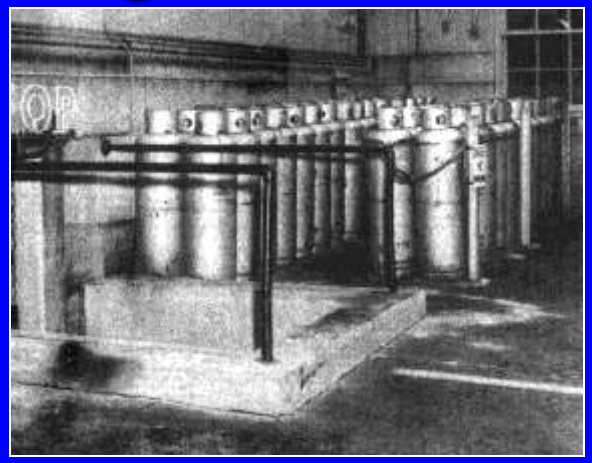
Note 2: If the cylinder is filled on site from a bulk truck, the filling connection and vent valve must be at least 10 ft from any exterior source of ignition, openings into direct-vent appliances, or mechanical ventilation air intakes. Refer to 3-2.2.2(d).

Note 3: Refer to 3-2.2.2(b).

Table 3-2.2.2

3 Additional Container Location Requirements

- 3-2.2.2 (a) if aggregate of small containers < 125 gal. WC (1040 Prop. Cap.) is 501 gal. or more:
  - Use table distances
  - 25 ft. to other container groups



- 3-2.2.2 (b): PRV on containers next to buildings:
  - 3 ft/5 ft (DOT/ASME) from building openings

Ch. 3-2.2.2

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3 Additional Container Location Requirements

- 3-2.2.2 (e): distance for one single container of <1,200 gal. is reduced to 10 ft. - must be 25 ft. from any other LP-Gas container >125 gal. a.k.a. “the restaurant exemption”
- 3-2.2.2 (f): underground container distances
- 3-2.2.2 (g): access to tank - ends or sides

Ch. 3-2.2.2(e-g)

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3 Notes to Table 3.2.2.2

- 3-2.2.2 (h): distance between buildings & ASME containers > 125 gal:
  - Apply 50 % of horizontal distance to building projection more than 5 ft. from the building wall & higher than the relief valve discharge outlet
  - Do not reduce distances in Table 3-2.2.2.
  - Do not apply if overhanging is >50 ft. above the relief valve discharge outlet

Ch. 3-2.2.2(h)

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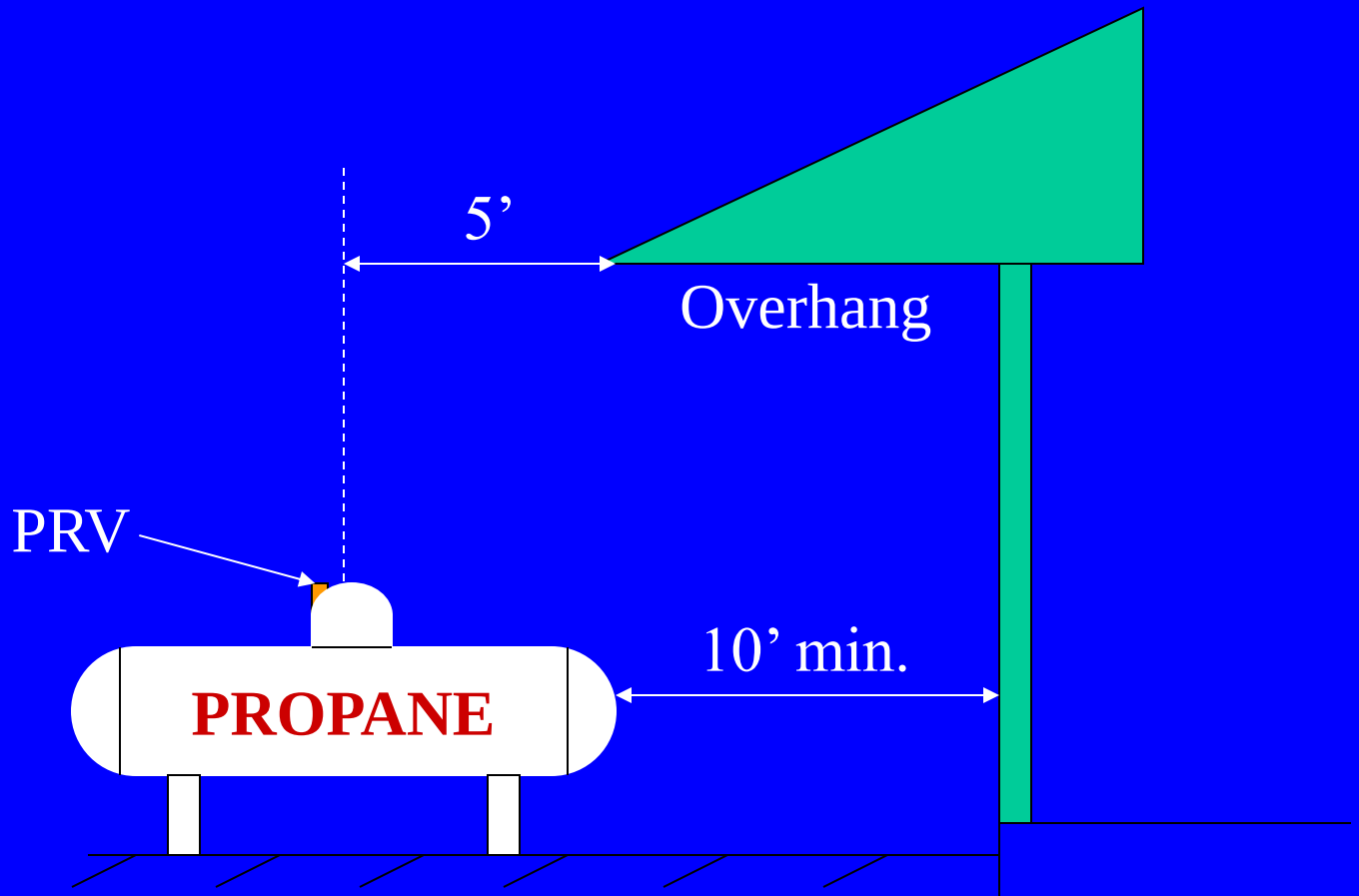
3 Table 3.2.2.2 Example



Ch. 3-2.2.2(h)

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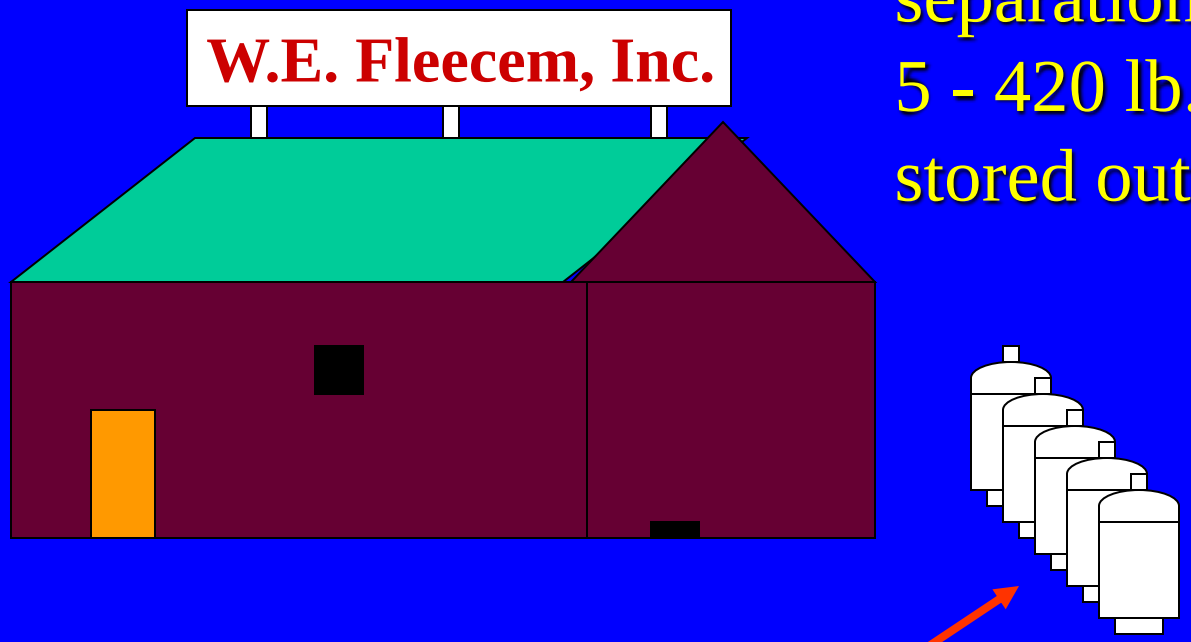
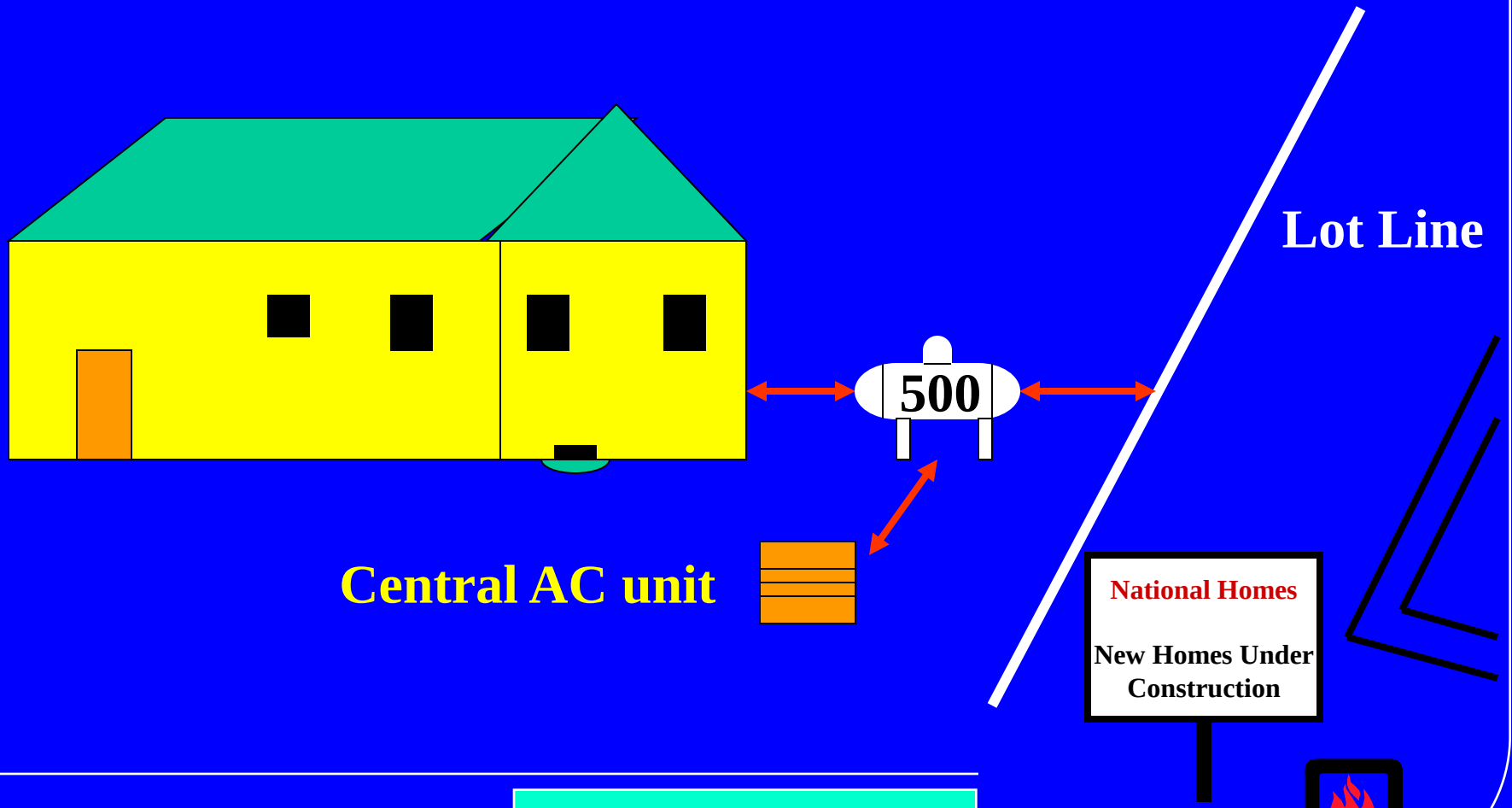
3 Ch. 3.2.2.2 Problem 2

What is the required separation distance of the 5 - 420 lb. cylinders to be stored outside of this factory?



Ch. 3-2.2.2

3 Ch. 3.2.2.2 Problem 3



Ch. 3-2.2.2

3 Ch. 3.2.2.2 Problem 3

For the previous house slide:

1. What is the minimum distance between the house & tank?

2. What is the minimum distance between the AC unit & tank?

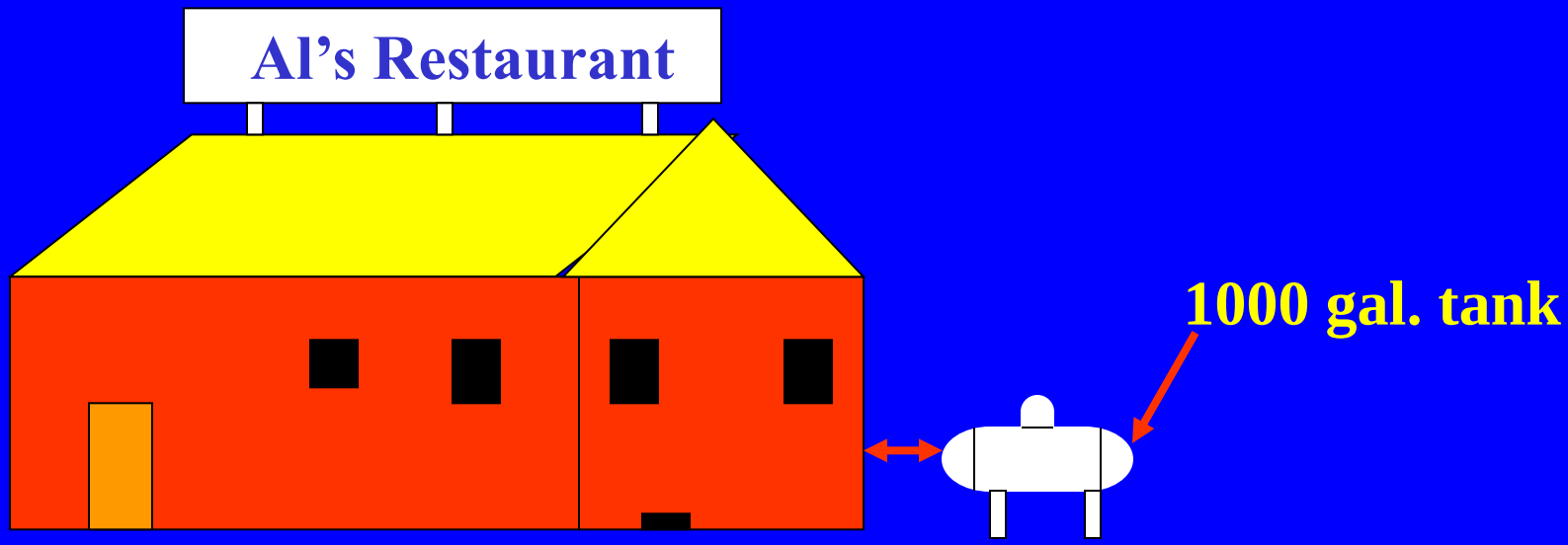
3. What is the minimum distance between the tank & the property line?

Ch. 3-2.2.2

NFPA®

3 Ch. 3.2.2.2 Problem 4

What is the acceptable separation distance for the 1000 gal. tank at this restaurant?



Ch. 3-2.2.2

3 Large Installations in Populated Areas

- More than 4,000 gal.
  - Located in heavily populated or congested areas
- Fire Safety Analysis (FSA) required, based on prevention of BLEVE
- The siting provisions can be modified as indicated by the FSA (See handbook for details)

Ch. 3-2.2.3

NFPA®

3 Multicontainer Installations

- Individual containers of 12,000 gal. or more
- Installed for use in a single location

Fire Protection	Containers (Max #/Group)	Distance (Ft)
Hose Streams	6	50
Fixed Monitor	6	25
Fixed Sprays	6	25
Insulation	9	25

- Reduce 50% when Ch. 3-11 used

Table 3-2.2.4

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3 Additional Container Installation Provisions

- Containers can **not** be stacked
- **No** loosely piled combustible material, dried weeds, long dry grass within 10 ft.
  - Live vegetation OK
  - Does **not** apply to densely packed mat'l (e.g. lumber)
- **No** accumulation or flow of liquids having flash points < 200°F under adjacent LP-Gas containers
- LP-Gas containers > 10 ft. from dikes containing flammable or combustible liquids

Ch. 3-2.2.7

NFPA®

3 Location of Transfer Operations

- Applies to location of **filling** operation **not** location of tank
- Use point of transfer - end of hose
- Applies to containers filled at dispensing stations
  - Applies to filling location remote from tanks
- **Not** used for fixed containers
- Independent of tank size
- Covers 11 exposures listed in Table 3-2.3.3

Ch. 3-2.3

NFPA®

3

Location of Transfer Operations

Part	Exposure	Minimum Horizontal Distance
A	Buildings, mobile homes, recreational vehicles, & modular homes w/ fire resistive walls	10 Ft.
B	Building w/ other than fire resistive walls	25
C	Building wall openings or pits at or below the level of the point of transfer	25
D	Line of adjoining property that can be built upon	25

Table 3-2.3.3

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3 Installation of Containers

General Rules

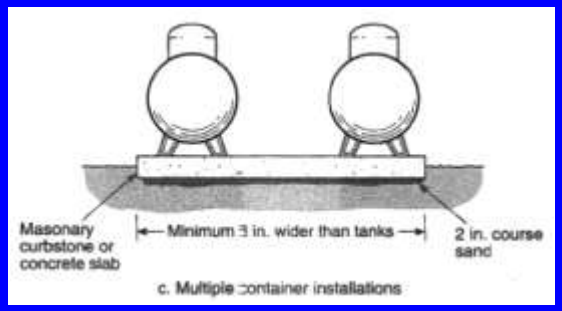
- Cylinders, aboveground & firm foundation
- PRV must communicate w/ vapor space
- Where physical damage to LP-Gas containers is possible - take precautions
- Field welding limited to attaching non-pressure parts
- Aboveground containers - kept painted

Ch. 3-2.4

NFPA®

3 Installation of ASME Containers

- Permanent horiz. aboveground ASME containers
  - On masonry or noncombustible structural supports on concrete, or
  - On insulated steel (2 hour)
  - Except in temporary use < 6 mos.
  - Except if in isolated locations



- Permanent vertical ASME containers >125 gal. on reinforced concrete or steel (2 hour rating) on reinforced concrete foundations

Ch. 3-2.4

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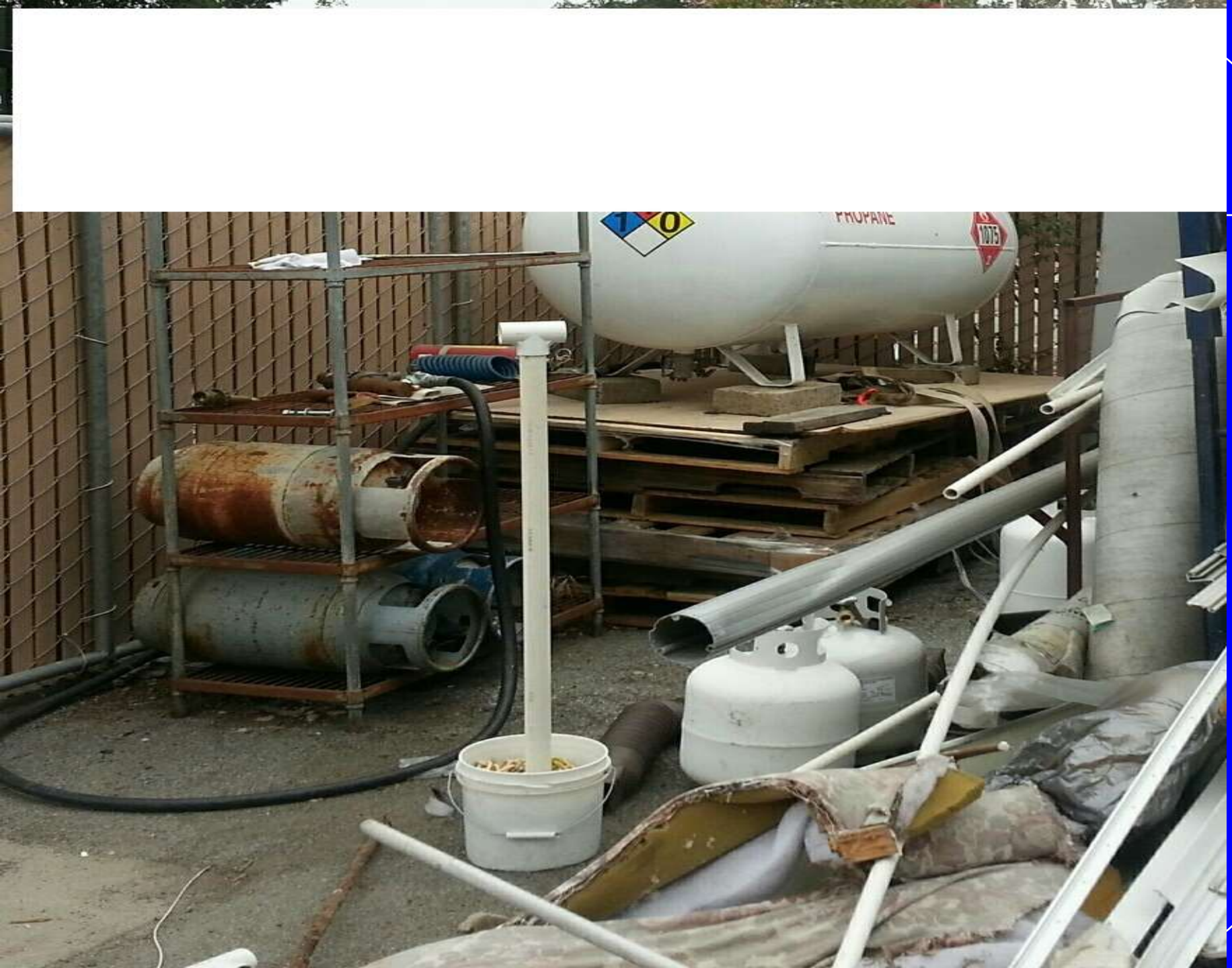
3 Installation of ASME Containers

Example ASME Aboveground LP-Gas Installation

Ch. 3-2.4

NFPA®


PROPANE


PROPANE
1075


Dispenser
PROPANE
FLAMMABLE
AAA
TRICOR
AVAILABLE HERE


VANTAGE
LINCOLN
ELECTRIC

3 Underground Containers

- At least 6” below grade
- If subject to vehicle damage - at least 18” below grade or protection (concrete slab, etc.)

- Within 10 ft. of vehicular traffic protect fitting housing, cover, connections, & piping
- Interchangeable aboveground - underground assemblies: container shell > 12” below grade

Ch. 3-2.4.8

NFPA®

3 Underground Containers

- Anyone working near U/G container must protect container & piping from vehicles
- Portion of container to which fitting cover is attached must be covered

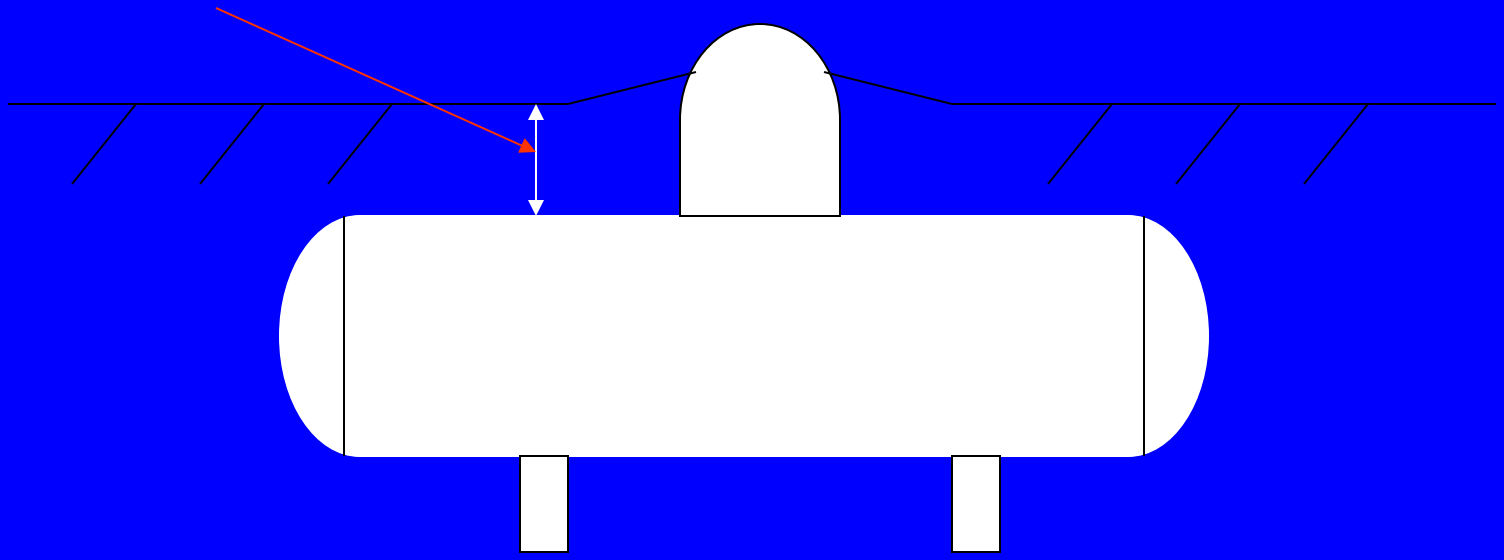
- Regulator vent discharge must be above highest probable water level
- Protect from corrosion

Ch. 3-2.4.8

NFPA®

3 Underground Containers

6” below min.
18” below min - vehicular exposure or protect
12” below min. - for interchangable above/under



Cross-section ASME Underground LP-Gas Container

Ch. 3-2.4.8

NFPA®

3 Installation of Container Appurtenances - PRVs

- PRVs must release gas upward away from container to open air on:
  - Direct communication w/vapor space - repeated throughout presentation
  - ASME containers over 125 gal.
  - Portable containers of 120 gal. or more
  - Cargo tanks & vehicle fuel containers

Ch. 3-2.6

NFPA®

3 Installation of Container Appurtenances

- Relief discharges must be upward at least 7 ft. above top of container > 2,000 gal.
- Relief valve piping - metallic w/ a melting point over 1500°F
- Shutoff valves can not be installed between relief devices & container or discharge piping
- Water must be kept out of PRVs

Ch. 3-2.6

NFPA®

3 Installation of Regulators

- Install as close to container/vaporizer as practical
- Install 1st stage regulating equip. outside building
- Must be securely attached
- Protect all outdoor regulators from the elements
- Regulator pressure relief discharge > 3 ft. from any building opening below it
- 5 ft. to ignition source

Ch. 3-2.7

NFPA®

3 Piping System Service Limitations

- LP-Gas liquid or vapor can be piped at all normal operating pressures outside buildings
- Polyethylene piping systems are limited to outdoors, underground only
  - Vapor service not exceeding 30 psig
  - LP-Gas vapor can not be > 20 psi in buildings, except in buildings under construction

Ch. 3-2.8

3 Emergency Shutoff Valves

- Required on systems of > 4,000 gal.

- ESVs must close on
  - 250°F < 5 ft. from end of hose or swivel piping
  - Manual shutoff from a remote location
  - Manual shutoff at valve
  - 1-1/4” vapor line

Ch. 3.2.10.11

NFPA®

3 Emergency Shutoff Valves

- On liquid piping > 1-1/2” within 20 ft. of end of piping connected to hose or swivel-type piping
- ESVs must be anchored
- Anchorage & breakaway on cargo tank side for transfer from a rail car

Ch. 3-2.10.11

NFPA®

3 Annual Testing

ESV& check valve maintenance **requirements**

- Must be in working order
- Annual testing & test result documentation
- All new & existing installations shall have one clearly identified, accessible, manually operated ES device > 20 ft. but < 100 ft. from ESV in egress path

Ch. 3-2.10.11

NFPA®

3 Hydrostatic Relief

- Hydrostatic relief or pressure relief device provided in each section of pipe & hose
- To relieve excess liquid pressure isolated between shutoff valves

- Relief setting- 400-500 psi or higher for higher pressure piping systems

Ch. 3-2.11

NFPA®

3 Pipe Testing

- Pipes & hoses shall be tested for leakage
- Normal operating pressure - minimum
- Piping under NFPA 54 - test in acc. w/ NFPA 54
- **No** flames

Ch. 3-2.12

NFPA®

3 Miscellaneous Protection

Heavy snow:

- Provide protection against snow & ice conditions

Corrosion:

- Minimize ground contact - minimize potential
- Protect exposed equipment & components - accepted engineering practice

Ch. 3-2.13 & 14

NFPA®

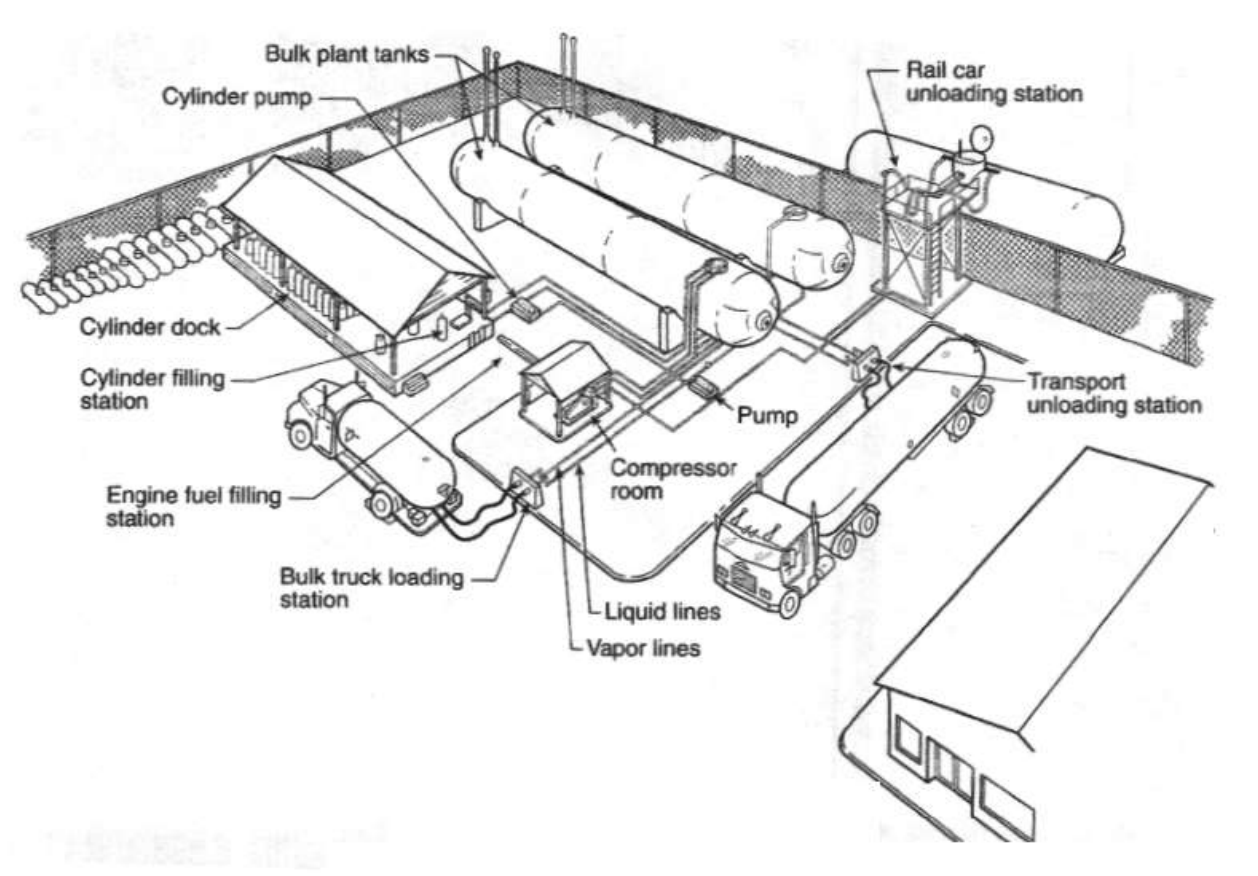
3 Equipment Installation

- Pumps, compressors, liquid/vapor meters - installed according to manufacturer
- Strainers shall be installed for easy service
- All equipment/components shall be mounted to minimize damage
- Flexible connectors allowed to minimize strain

Ch. 3-2.15

NFPA®

3 Bulk Plant & Industrial Systems



Ch. 3-3

NFPA®

3 Bulk Plant & Industrial Systems

- All installations of > 2000 gal. are either bulk or industrial plants
- ESV required for liquid transfer
- Lighting required for night operations.
- Buildings housing operations - comply w/ Ch. 7
- Protection against tampering required:
  - 6’ industrial fence - 2 openings (1 if < 100 $ft^{2)}$, or
  - Lock all equipment not in use

Ch. 3-3

NFPA®

3 Buildings Housing Industrial Occupancies

- Containers in industrial buildings for processing, research, or experimental purposes OK when:
  - Total LP-Gas < 300 lb. - additional 300 lb. 20’ away
  - The amount of LP-Gas for research & experimental use is smallest practical quantity
  - Containers for temporary heating are OK in noncombustible industrial buildings if essential, & permanent heat not practical

Ch. 3-4.5

NFPA®

3 Temporary Heating in Buildings in Emergencies

- Containers can be used in buildings for temporary emergency heating:
  - If necessary to prevent damage to building or content, and
  - If permanent heating system is temporarily out of service
- Temporary heating equipment shall **<u>ALWAYS BE ATTENDED!</u>**

Ch. 3-4.7

NFPA®

3 Installation of Appliances

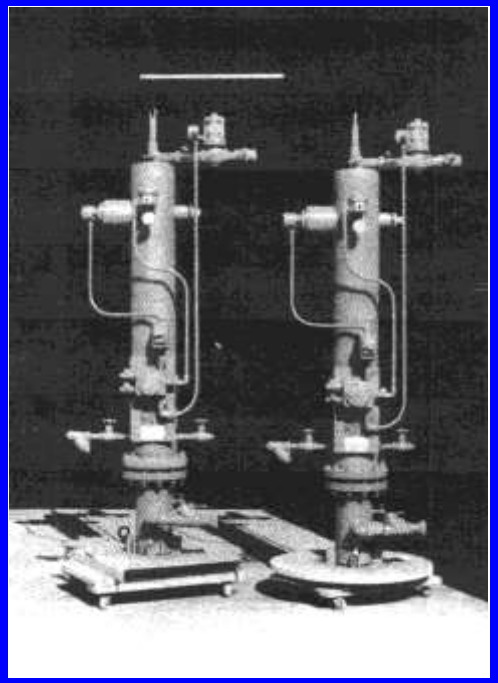
- Covers installation of LP-Gas appliances in accordance w/ Ch. 2-6
  - For appliances in buildings served by a fixed gas supply - use NFPA 54
  - Appliances on commercial vehicles - see Ch. 3-8
  - AHJ can approve unattended heaters for animal or poultry production
  - Appliances in structures without enclosing walls do not need an automatic flame safety device

Ch. 3-5

NFPA®

3 Vaporizers

- Direct-fired vaporizers
- Install outdoors or in Ch. 7 building
- Connect inlet to container liquid outlet
- Separate from exposures per Table 3-6.3.5



Ch. 3-6

NFPA®

3 Vaporizers

- Indirect-Fired Vaporizers
  - Install outdoors or in Ch. 7 building
  - If fired heat source < 15 ft. install as a direct-fired

- Vaporizing burners
  - Outdoors only
  - Separate from container per Table 3-6.5

Ch. 3-6

NFPA®

3 Ignition Source Control

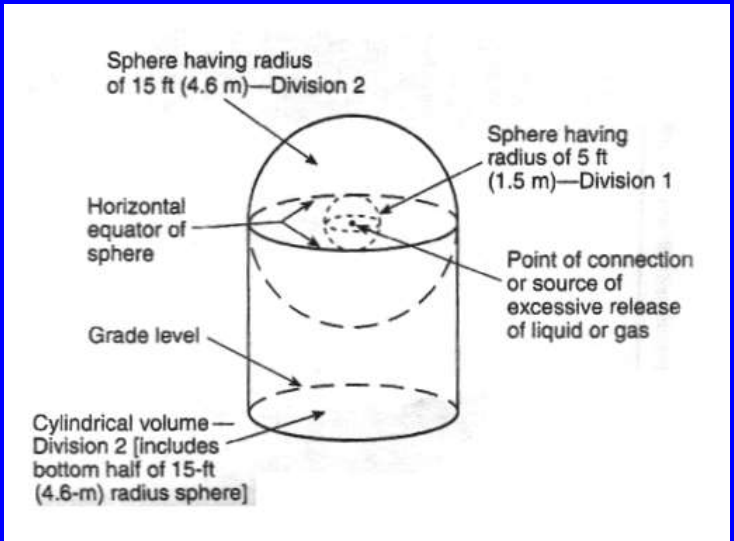
- Provisions to minimize ignition of LP-Gas resulting from LP-Gas release
- Lightning protection equipment is **not** required on LP-Gas storage containers
  - NOTE: For info see NFPA 780
- Grounding & bonding are **not** required on LP-Gas systems
  - NOTE: LP-Gas need not be electrically conductive or electrically bonded - see NFPA 77

Ch. 3-7

NFPA®

3 Ignition Source Control

- Table 3-7.2.2 provides extent of classified areas for Class I, Divisions 1 & 2
- Industrial usage only
- Distances provided for:
  - Containers
  - Tank vehicles
  - Relief devices
  - Pumps, etc.



Extent of Classified Area

Table 3-7.2.2

3 Ignition Source Control

- National Electrical Code (NFPA 70)
- Class I Locations: Class I locations are those which flammable gas or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitible mixtures.

- Class II pertains to dust - N/A
- Class III pertains to fibers & flyings - N/A

NEC

NFPA®

3 Ignition Source Control

Class I Group Classifications

- Group A
- Group B
- Group C

} Cover other flammable gases

- Group D: Covers butane, natural gas, propane

NEC

NFPA®

3 Ignition Source Control

Class I, Division 1

Areas containing ignitible concentrations of flammable gases/vapors

(1) During normal operating conditions

(2) During repair/maintenance operations

(3) Due to leakage

(4) Breakdown or faulty equipment operation

NEC

NFPA®

3 Ignition Source Control

Class I, Division 2

Areas containing ignitible concentrations of flammable gases/vapors under abnormal conditions

(1) Accidental escape from closed container/system

(2) Mechanical ventilation failure

(3) Adjacent to Class I, Division 1 areas

NEC

NFPA®

3 Ignition Source Control

Table 3-7.2.2

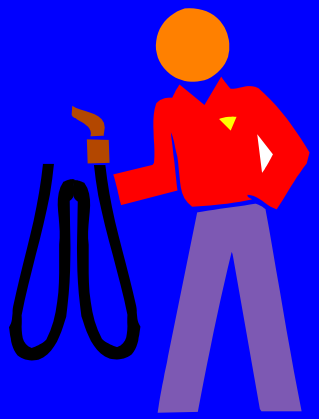
Part	Location	Classified Area	NEC Class I, Group D*
A	Unrefrigerated	15’ all around	Division 2
B	Refrigerated	15’ all around	Division 2
	Inside dike	Area inside dike to the level of the top of the dike	Division 2

Table 3-7.2.2

NFPA®

3 Vehicle Fuel Dispenser & Dispensing Stations

- General installation provisions
  - Outside of buildings
  - Can be under a shelter or canopy when enclosed < 50% of perimeter
  - Control for pump is provided at pump to minimize leakage or discharge
  - An excess-flow check valve, or an ESV is installed at end of liquid piping at dispensing hose attachment
  - Trespassing & tamper protection



Ch. 3-9

NFPA®

3 Vehicle Fuel Dispenser and Dispensing Stations

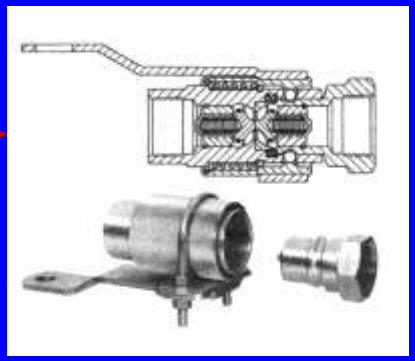
- Dispenser on concrete foundation
- Listed quick-acting shutoff at discharge end of hose
- Hose must have hydrostatic relief valve
- Protect from physical damage
- Electrical shut-off 20’ - 100’ from dispenser w/ location visible from point of transfer

Ch. 3-9

3 Installation of Vehicle Fuel Dispensers (Add'l Rules)

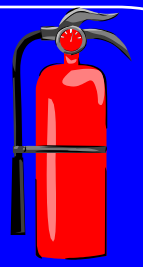
- Hose length 18 ft max. - must be listed
  - May be waived by AHJ
- A listed emergency breakaway device that retains liquid on both sides of breakaway point
- LP-Gas dispensers must be 3' - 10' from Class 1 liquid dispensers

Pull-away Valve



Ch. 3-9

3 Fire Protection

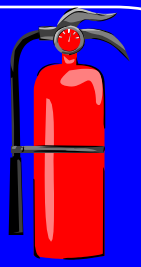


- Needed for installations over 4,000 gal.
- Fire (special) protection required - determine through a competent Fire Safety Analysis.
  - The First Consideration in any such analysis shall be an analysis of the total product control system including emergency internal and external shutoff valves having remote and thermal shutoff capability
- Provide access for emergency equipment

Ch. 3-10

NFPA®

3 Fire Protection



- One approved portable fire extinguisher 18 lb. dry chemical (B:C rating) at each industrial plant, bulk plant, & distributing point
- LP-Gas fires must not be extinguished until source of burning gas is shut off
- Emergency controls - conspicuously marked, & located readily accessible in emergencies

Ch. 3-10

NFPA®

3 BLEVE

- Boiling Liquid Expanding Vapor Explosion
- Physical phenomenon (not chemical)
- Tank cannot hold internal design pressure
  - Due to change in physical characteristics "softening" of tank
  - Mechanical failure
    - Wall thickness reduction
    - Exterior damage (e.g. corrosion)

Ch. 3-10

3 Special Protection

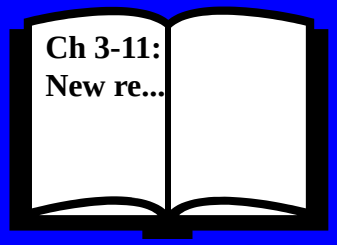
- Insulation must limit container to 800°F for 50 minutes, & resist weathering & hose streams
- Mounding & burial of tanks OK
- Water spray fixed systems - comply w/ NFPA 15
- Monitor nozzles must wet all surfaces exposed to fire & comply w/ NFPA 15

Ch. 3-10.3

NFPA®

3 Alternate Installation Provisions for Containers to Reduce Distances

- New requirements in Ch. 3-11



- Underground & mounded containers 2,000 - 30,000 gal. can be installed
  - 10 ft. from bldgs & lines of adjoining properties (Normally 50 ft.)
  - Internal valves required
  - Redundant fail-safe product measures required

Ch. 3-11

NFPA®

3 Alternate Installation Provisions for Containers to Reduce Distances

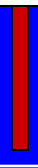
- When liquid & vapor (≥ 1-1/4”) openings have an internal valve w/ excess flow valve that:
  - Have remote operation
  - Remain closed except when operating
  - Have closure < 15’ and 25’ - 100’ from transfer point
  - Have automatic fire shutoff
- Check valve is an acceptable alternate

Ch. 3-11

NFPA®

3 Alternate Installation Provisions for Containers to Reduce Distances

- Redundant fail-safe product control measures
  - Automatic closure of ESV's & internals on pullaway
  - Remote tank valve shutdown by fire & pullaway
  - Remote Valve & power to pump shutdown
    - Within 15 ft. of the point of transfer
    - 25 - 100 ft. from the point of transfer
  - Sign: **Propane Emergency Shutoff** @ shutdown pts.



Ch. 3-11

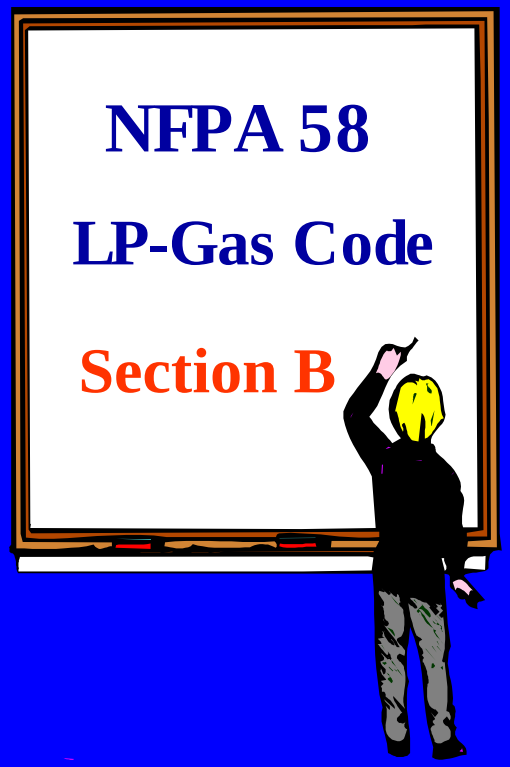
NFPA®

Section B
Transfer & Storage

Objectives

Provide participants with the ability to locate and apply information related to the requirements of LP Gas

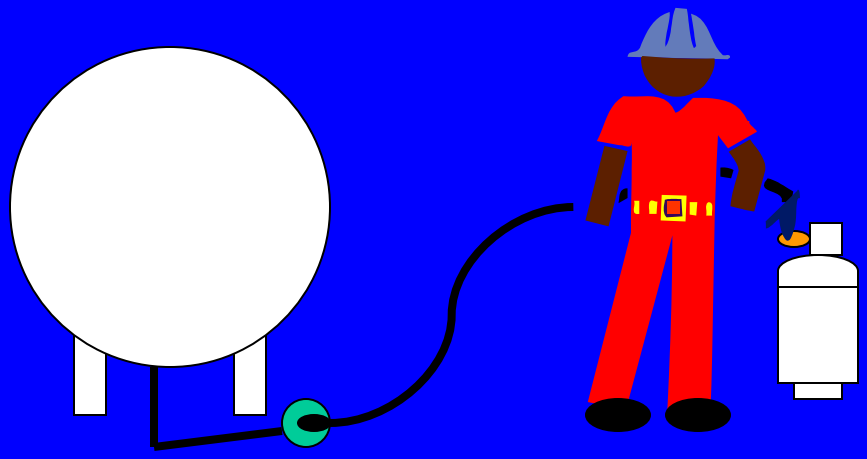
1. Liquid Transfer &
2. Portable Container Storage



Ch. 4&5

Section B - Problem 1

The pump situation below represents a local tank filling operation for portable size LP-Gas containers. The following questions will be on the responsibilities during the filling process.



Section B - Problem 1

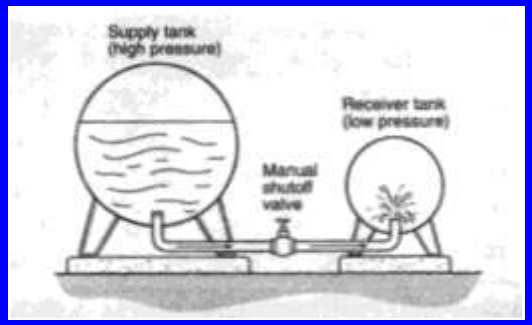
1. Who is permitted to fill the LP-Gas container?
2. The owner of the tanks hands you two tanks to fill, one is damaged and one is not. What do you do?
3. The owner's car is running about 5 ft. away from the filling point, what do you do?
4. Another customer arrives while you are filling the tank, with a leaking tank. Do you leave and let the first customer finish filling the tank? Why?
5. What are your remaining filling procedures?

4 LP-Gas Liquid Transfer

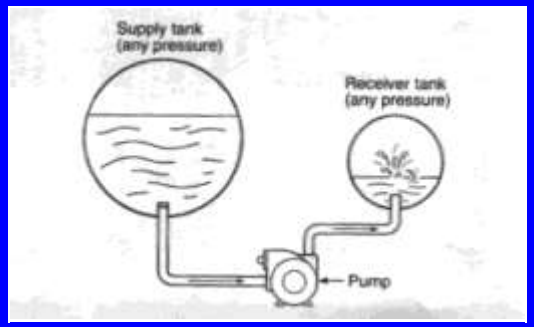
- 4-1 Scope
- 4-2 Operational Safety
- 4-3 Venting LP-Gas to the Atmosphere
- 4-4 Quantity of LP-Gas in Containers

4 LP-Gas Liquid Transfer

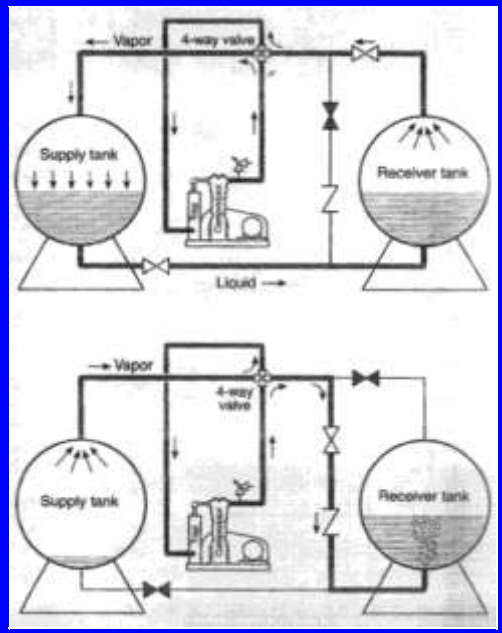
- Covers all transfers of liquid between containers



Gravity Transfer



Pump Transfer



Compressor Transfer

4 Operational Safety

- Operations only by qualified personnel
- At least one qualified person in attendance during transfer
- Notify container owner & user in writing when a container is not suitable for filling
- Container valve outlets <45 lb. need plug, cap or quick coupling when not connected for use
- **No** public access to storage & transfer areas

Ch. 4-2

4 Operational Safety

- Sources of ignition off during transfer
  - **No** smoking, open flames, welding, etc. within 25 ft. of point of transfer during filling
  - **No** internal combustion engine operation within 15 ft.
  - Ignition sources on vehicles - **off** during filling
  - Cargo vehicles unloading into storage containers at least 10 ft. from container

Ch. 4-2.3.2

NFPA®

4 Venting LP-Gas to the Atmosphere

- Venting:
  - Vent only thru No. 54 drill orifice
  - Hoses between shutoff valves
- Purging:
  - Indoors in Ch. 7 buildings only
  - Outdoors if gas disperses rapidly, if not, burn under controlled conditions

Ch. 4-3

4 Quantity of LP-Gas in Containers

- Normal filling limit is 80% by volume
- The maximum permitted filling limit for any container where practical - determined by weight
- The volumetric method is permitted for portables if designed & equipped for filling by volume
- Tables provided for filling based on temperature & density of LP-Gas

Ch. 4-4

5 Storage Within Buildings

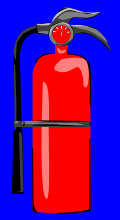
- Buildings frequented by the public
  - 1 lb. max. cylinders, used w/ Hand Torches, etc., 200 lb. LP-Gas max.
  - In restaurants & food service - 24 Butane cylinders Add'l 24 w/ 2 hr. rating
  - Residential buildings - max. 2 - 1 lb. containers
- Buildings not frequented by public - 300 lb. max.
- Special buildings or rooms (see Ch. 7)
  - 10,000 lbs. max. - not next to schools, churches, etc.

Ch. 5-3

NFPA®

5 Storage Outside of Buildings

- Storage outside of buildings per Table 5-4.1 & at least 20 ft. from any public doorway
  - TIA changes to 5/10 ft. w two/one means of egress
- Alternate storage locations can be approved by AHJ - construction sites & building renovations
- Fire protection: min. 1-18lb. B:C dry chem.



Ch. 5-4

NFPA®

5 Storage Outside of Buildings

Quantity Stored (Lbs Prop.)	Distance to Buildings & Prop. Lines (Ft)	Distance to Streets & Schools (Ft)	Distance to Dispensing Stations (Ft)
720 or less	0	0	5
721-2500	0	10	10
2,501-6,000	10	10	10
6,001-10,000	20	20	20
Over 10,000	25	25	25

Table 5-4.1

NFPA®

5 Protection of Cylinders

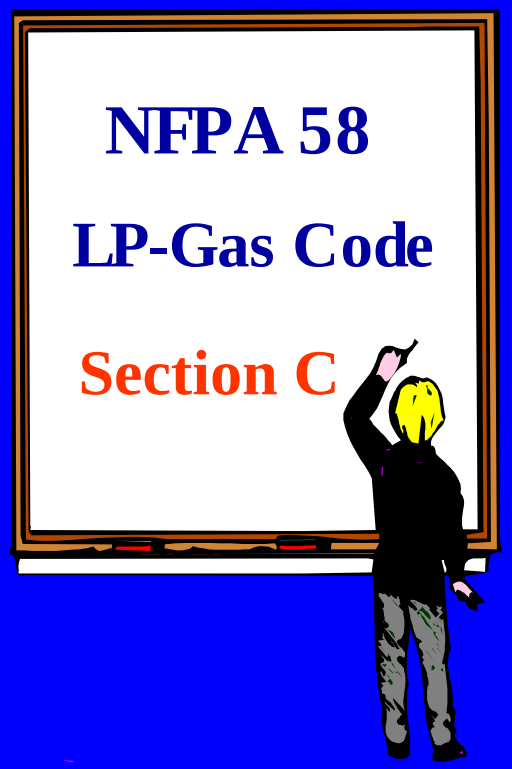
- Enclosure w/ industrial fence, or
- Lockable, ventilated metal cabinet that prevents tampering w/ valves & theft, vehicular damage
- Protect from vehicle impact

Ch. 5-4.2

Section C
Vehicular Transportation

Objectives

Provide participants with the ability to locate and apply information related to the requirements of Vehicular Transportation of LP-Gases



Ch. 6

Section C - Questions

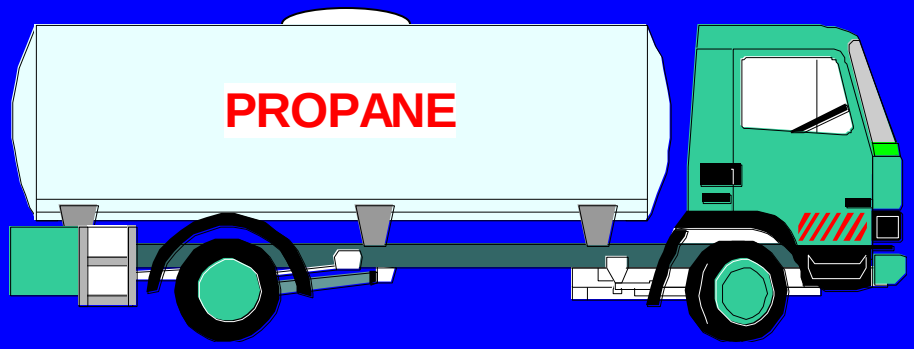
1. In order to ship LP-Gas in a bulk cargo truck, what regulations must the vehicle comply with?
2. What minimum mandatory type fire protection is required when transporting LP-Gas?
3. When shipping with a cargo transport vehicle (CTV) over a public way, what is its max. allowable LP-Gas liquid capacity?
4. What is required when leaving a CTV outdoors in a stationary position ?
5. What if you parked the CTV inside of a garage?

6 Vehicular Transportation of LP-Gases

- 6-1 Scope
- 6-2 Transportation in Portable Containers
- 6-3 Transportation in Cargo Vehicles
- 6-4 Trailers, Semitrailers, and Movable Fuel Storage Tenders, Including Farm Carts
- 6-5 Transportation of Containers to and from the Point of Installation
- 6-6 Parking and Garaging Vehicles Used to Carry LP-Gas Cargo

6 Vehicular Transportation

- Applies to bulk transportation & cylinders
- Provides extension of DOT regulations



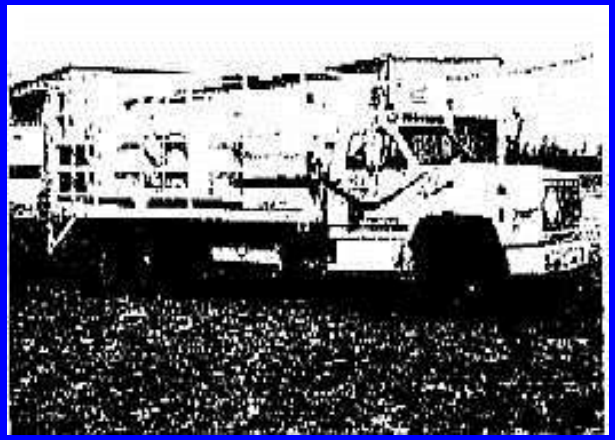
- Does **not** apply to cylinders & related equipment incident to their use on vehicles as covered in Ch. 3-8 & Ch. 8

Ch. 6-1.1

NFPA®

6 Transportation in Portable Containers

- Transportation of filled containers
- Includes DOT cylinders
- Separate requirements for:
  - Cylinders (< 1000 lb.)
  - Tanks (> 1000 lb.)



- Fire protection: min. 1-18lb. B:C dry chem.
- Placard vehicles per DOT regulations

Ch. 6-2

NFPA®

6 Transportation in Cargo Vehicles

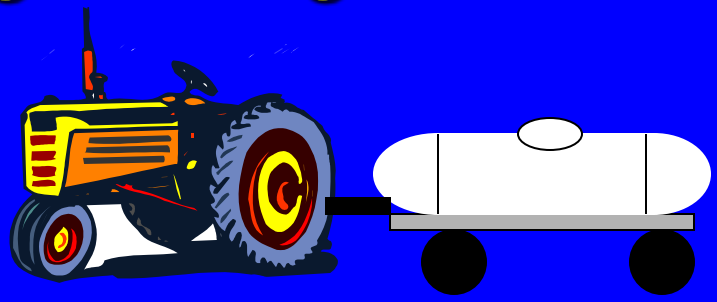
- Vehicle construction, piping, hoses, fittings, & valves - must meet DOT requirements
- Equipment (pumps, regulators, etc.) - comply w/ Ch. 2-5 (design & constr.) & Ch 3-2.15 (install.)
- Smoking **prohibited** within 25 ft.

- Fire protection: min. 1-18lb. B:C dry chem.

Ch. 6-3

6 Farm Carts

- Must maintain safety & protection precautions
- Positioned properly for pressure relief
- **No** more than 5% filled when transporting
- Shall **not** be filled on a public way
- Shall use min. Sch. 80 piping & fittings
- Designed for 250 psi min.



Ch. 6-4

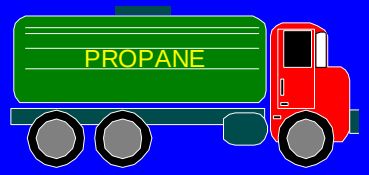
6 Transportation of Stationary Containers

- Applies to stationary containers to & from point of installation
- ASME > 125 gal. shall be <5% liquid full during transportation
- Safe & secure - protected against damage
- PRV in vapor space

Ch. 6-5

NFPA®

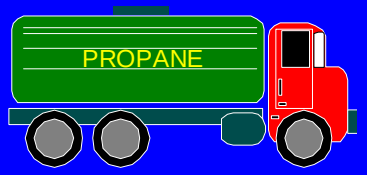
6 Parking



- Not applicable to liquid transfer operations - **Applies to parking only!**
- Do **not** leave unattended
  - Exception: stopping for meals or rest, day or night
- **No** parking in congested areas
- 50’ from institutional, assembly, multi-residential
- Driver may park in own residential area. if uncongested & can meet 50’ requirements

Ch. 6-6.2.1

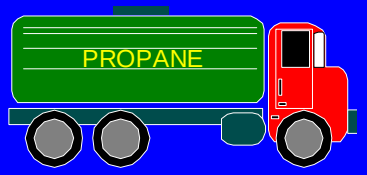
6 Garaging



- Vehicles must be liquid empty & depressurized
- Piping and hoses empty
- Hoses & valves capped or plugged
- Portable carriers must remove all containers
- Vehicles with liquid can be parked in a building complying with Ch. 7, if controlled by vehicle operator

Ch. 6-6.2.2

6 Servicing



- Indoor service allowed in shop controlled by operator when:
  - Vehicle (tank, pipes, hoses) is empty;
  - or in a Ch. 7 building
- Indoor service allowed in a public garage when:
  - Vehicle (tank, pipes, hoses) is empty
- Driver is always in attendance

Ch. 6-6.2.3

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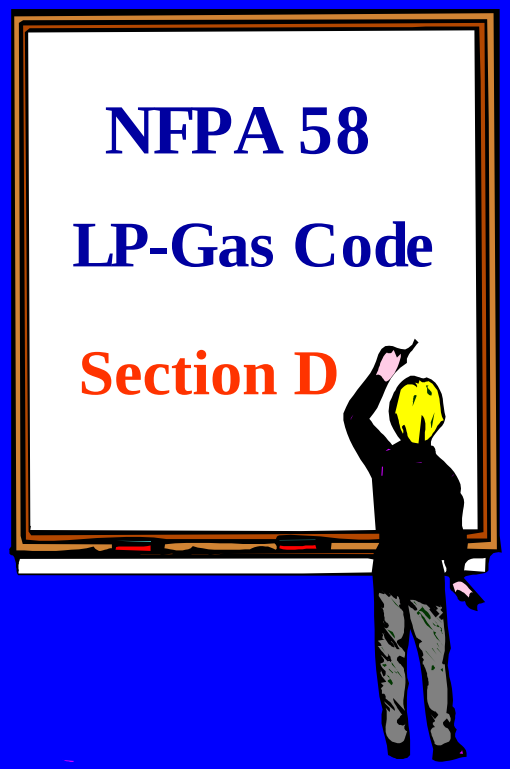
Section D
Distribution Facilities

Objectives

Provide participants with the ability to locate and apply information related to the requirements of Building or Structures Housing LP-Gas Distribution Facilities



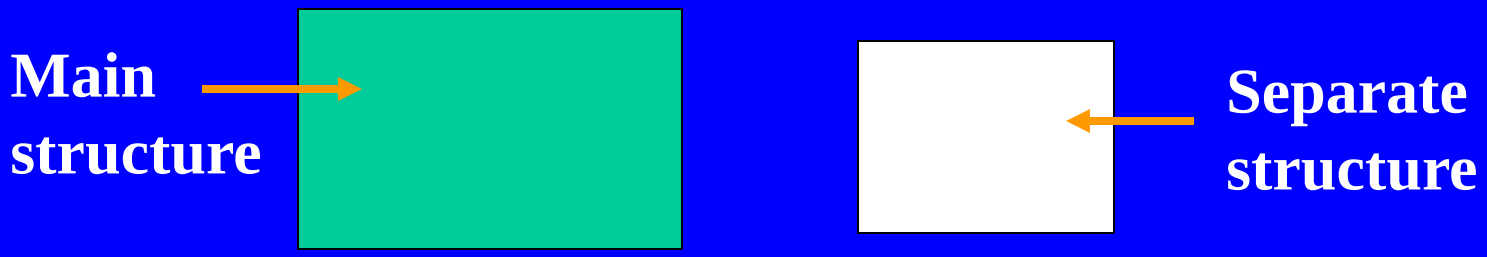
Ch. 7

7 Building or Structures Housing LP-Gas Distribution Facilities

- 7-1 Scope
  - For structures constructed or converted after 12/31/72
- 7-2 Separate Structures or Buildings
- 7-3 Attached Structures or Rooms within Structures

7 Separate Structures or Buildings Construction

- One story construction only
- Non-combustible walls, ceilings, floors, & roofs
- Lightweight material for explosion venting
- Heavy construction - 1 sq. ft. vent/50 cu. ft.
- Floors shall above ground level & solid filled



Ch. 7-2.1

NFPA®

7 Separate Structures or Buildings Ventilation

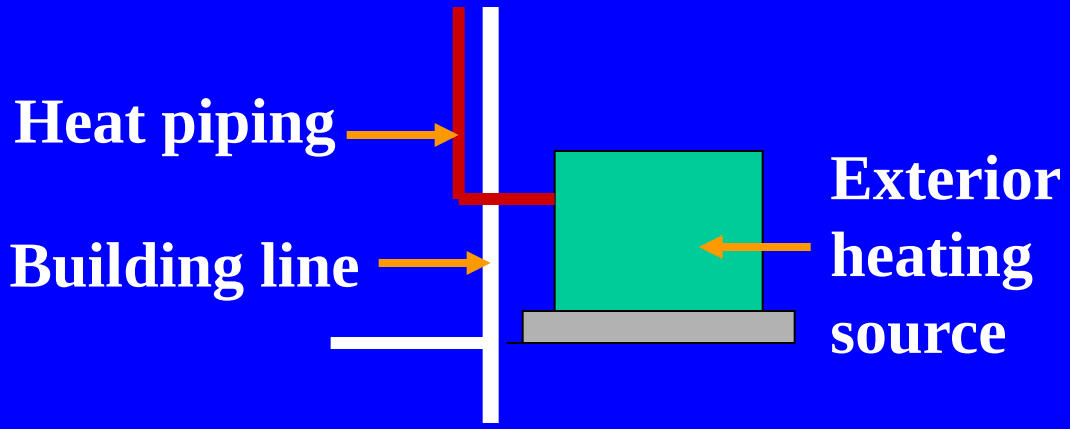
- Ventilation inlets/outlets < 6 in. above floor
- Locate openings to provide movement across floor
- Mechanical: 1 cu.ft./min-sq.ft. floor area
- Natural: 50 sq.in./20 ft. wall length (or fraction) - a min. of 1 sq.in./1 sq.ft floor area

Ch. 7-2.2

NFPA®

7 Separate Structures or Buildings Heating

- Steam, water, or other heat transfer medium
- Outside source



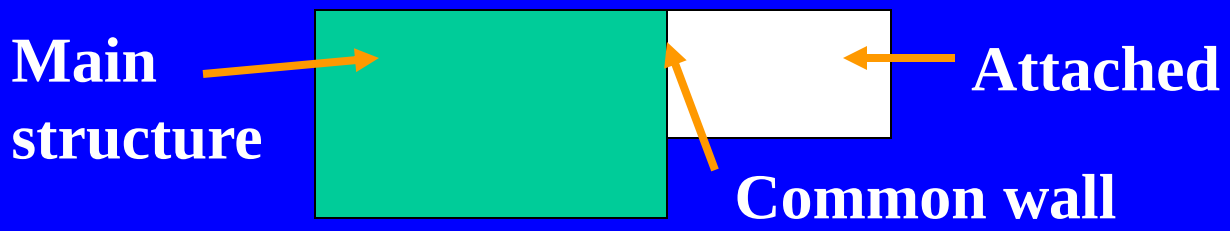
- By electrical heat
  - In accordance w/ NFPA 70, Class I, Group D, Div. 2

Ch. 7-2.3

NFPA®

7 Attached Structures

- Attachment: max. 50% of perimeter enclosed
- Common walls: 1 hr. fire rating, no openings
  - **Exception**: doors in LP storage area - 1-1/2 hr. rating
  - May waive if attached to building w/ similar hazard
- Withstand 100 psf static pressure
- Meet ventilation & heating in Ch. 7-2.2 & 7-2.3



Ch. 7-3.1

7 Rooms Within Structures

- Noncombustible construction

- First floor only w/ explosion venting (NFPA 68)
- Walls & ceilings: 1 hr. fire rating, no openings
  - **Exception**: doors in LP storage area - 1-1/2 hr. rating
  - May waive if attached to building w/ similar hazard
- Withstand 100 psf static pressure
- Meet ventilation & heating in Ch. 7-2.2 & 7-2.3

Ch. 7-3.2

12 Referenced Publications

NFPA, API, ASCE, ASME, ASTM, AWS, CGA, ICBO, UL, Federal

Ch. 12

Appendices

- Appendices are **not** the Code! - **Not Enforceable**
- **Appendix A**: Explanatory Material - additional non-mandatory material (e.g. detail drawings) that is informative or directs users to other non-mandatory sources (e.g. Guides, etc.)
- **Appendix B**: Properties of LP-Gases

Appendix A-B

Appendices

- **Appendix C**: Design, Construction, and Requalification of DOT (ICC) Cylinders - general information on cylinders
- **Appendix D**: Design of ASME and API-ASME Containers - general information on design & construction of these types of containers
- **Appendix E**: Pressure Relief Devices - for DOT cylinders & ASME containers

Appendix C-E

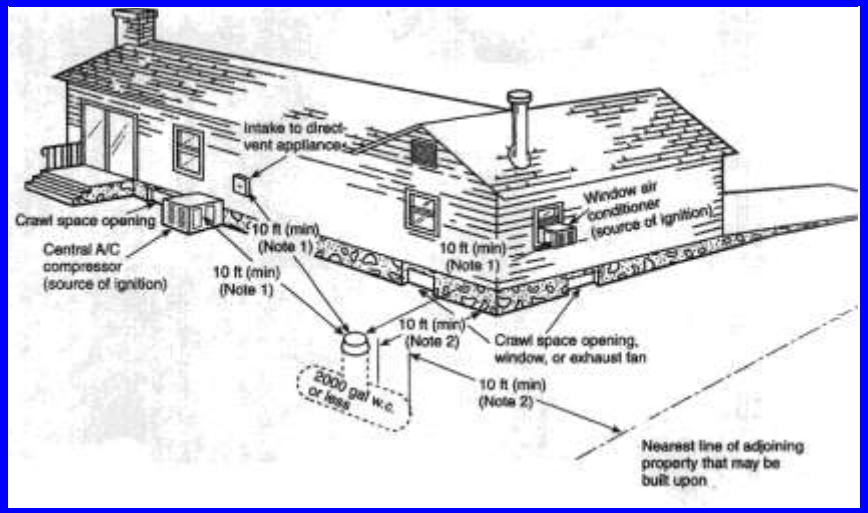
Appendices

- **Appendix F**: Liquid Volume Tables, Computations, and Graphs - basis for Table 4.4.2.1 including Table F-4, & how to use it
- **Appendix G**: Wall Thickness of Copper Tubing - one table on wall thickness specifications
- **Appendix H**: Procedure for Torch Fire Hose and Hose Stream Testing of Thermal Insulating Systems for LP-Gas Containers (To be deleted)

Appendix F-H

Appendices

- **Appendix I**: Container Spacing - sketches showing typical container placement



- **Appendix J**: Referenced Publications - additional publications for information only

Appendix H-J